

APPENDIX A
ADDITIONAL ASSUMPTIONS

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ADDITIONAL ASSUMPTIONS

A.1 CASK TYPE ASSUMPTIONS

As discussed in Section 2.2, current licensing actions and casks designs were examined to predict the most likely transportation casks. Table A-1 shows the characteristics of the resulting cask types, including capacity, weight, and heat limit. Table A-2 summarizes the 17 unique cask types and the 39 variations created by derating, switching BWR/PWR baskets, or removing the basket, to enable the shipment of DPCs.

Table A-1. Commercial Spent Nuclear Fuel Transportation Casks

Cask Designator	Description	Type	SPC/DPC	Capacity (Assys)	Nominal Hook Weight (Tons)	Heat Limit (Watts/ Assy)
Truck Casks						
P-T-1-SP	PWR NAC LWT	PWR	SPC	1	25	2,500
B-T-2-SP	BWR NAC LWT	BWR	SPC	2	25	1,100
P-T-4/4-SP	GA-4 LWT-4 Assemblies	PWR	SPC	4	26	617
P-T-4/3-SP	GA-4 LWT-3 Assemblies	PWR	SPC	3	26	740
P-T-4/2-SP	GA-4 LWT-2 Assemblies	PWR	SPC	2	26	1,234
B-T-9/9-SP	GA-9 LWT-9 Assemblies	BWR	SPC	9	26	235
B-T-9/7-SP	GA-9 LWT-7 Assemblies	BWR	SPC	7	26	303
B-T-9/5-SP	GA-9 LWT-5 Assemblies	BWR	SPC	5	26	406
B-T-9/4-SP	GA-9 LWT-4 Assemblies	BWR	SPC	4	26	530
B-T-9/2-SP	GA-9 LWT-2 Assemblies	BWR	SPC	2	26	730
SPC Rail Casks						
P-R-12-SP	PWR Generic Small SPC	PWR	SPC	12	75	1,000
B-R-32-SP	BWR Generic Small SPC	BWR	SPC	32	75	466
P-R-21-SP	PWR Generic Medium SPC	PWR	SPC	21	100	1,000
B-R-44-SP	BWR Generic Medium SPC	BWR	SPC	44	100	466
P-R-24-SP	PWR Generic Large SPC	PWR	SPC	24	125	706
B-R-68-SP	BWR Generic Large SPC	BWR	SPC	68	125	238
P-R-7-SP-HH	PWR Small SPC-HH	PWR	SPC	7	75	6,000
B-R-17-SP-HH	BWR Small SPC-HH	BWR	SPC	17	75	2,400
P-R-12-SP-HH	PWR Medium SPC-HH	PWR	SPC	12	100	6,000
B-R-32-SP-HH	BWR Medium SPC-HH	BWR	SPC	32	100	2,400
P-R-ST17-SP	South Texas SPC	PWR	SPC	17	125	1,000
P-R-ST7-SP-HH	South Texas SPC-HH	PWR	SPC	7	100	6,000
P-R-WV20-SP	PWR West Valley SPC	PWR	SPC	20	100	N/A

Table A-1. Commercial Spent Nuclear Fuel Transportation Casks (Continued)

Cask Designator	Description	Type	SPC/DPC	Capacity (Assys)	Nominal Hook Weight (Tons)	Heat Limit (Watts/ Assy)
P-R-9-SP-MOX	PWR MOX SPC	PWR	SPC	9	100	1,000
B-R-WV44-SP	BWR West Valley SPC	BWR	SPC	44	100	N/A
DPC Rail Casks						
P-R-24-OV	PWR Generic DPC	PWR	DPC	24	125	706
B-R-68-OV	BWR Generic DPC	BWR	DPC	68	125	238
P-R-WES21-OV	PWR WESFLEX DPC	PWR	DPC	21	100	1,000
B-R-WES44-OV	BWR WESFLEX DPC	BWR	DPC	44	100	466
P-R-VSC24-OV	Transtor DPC	PWR	DPC	24	125	1,000
P-R-MP24-OV	MP-187 DPC	PWR	DPC	24	125	764
P-R-HI24-OV	PWR HISTAR-100 DPC	PWR	DPC	24	125	706
B-R-HI68-OV	BWR HISTAR-100 DPC	BWR	DPC	68	125	238
P-R-NAC26-OV	PWR NAC UMS DPC	PWR	DPC	26	125	800
B-R-NAC56-OV	BWR NAC UMS DPC	BWR	DPC	56	125	300
P-R-YR36-OV	Yankee Rowe DPC	PWR	DPC	36	125	347
B-R-BP64-OV	Big Rock Pt DPC	BWR	DPC	64	125	378
P-R-ST17-OV	South Texas DPC	PWR	DPC	17	125	1,000
P-R-9-OV-MOX	PWR MOX DPC	PWR	DPC	9	100	1,000

Assy = Assembly
 B = BWR
 DPC = Dual-Purpose Canister
 HH = High Heat
 LWT = Legal Weight Truck
 MOX = Mixed Oxide
 N/A = Not Applicable
 OV = Overpack (for DPCs)
 P = PWR
 R = Rail
 SP = Single Purpose
 SPC = Single Purpose Cask
 T = Truck

Table A-2. Cask Type Summary

Cask Type	Description	BWR	PWR	SPC	DPC	Configurations
1	NAC LWT	X	X	2	--	2
2	GA-4	--	X	3 ^a	--	3
3	GA-9	X	--	5 ^a	--	5
4	Generic Small	X	X	2	--	2
5	Generic Medium/WESFLEX	X	X	3 ^b	3 ^b	6
6	Generic Large/HISTAR-100	X	X	2	4	6
7	Small HH	X	X	2	--	2
8	Medium HH	X	X	2	--	2
9	South Texas	--	X	1	1	2
10	South Texas HH	--	X	1	--	1
11	PWR West Valley	--	X	1	--	1
12	BWR West Valley	X	--	1	--	1
13	Transtor	--	X	--	1	1
14	MP-187	--	X	--	1	1
15	NAC UMS	X	X	--	2	2
16	Yankee Rowe	--	X	--	1	1
17	Big Rock Pt	X	--	--	1	1

NOTES: ^a Includes derated configurations.

^b Includes PWR MOX.

A.2 SCENARIO DESCRIPTIONS

Case A. Fuel selection begins with 10-year-old fuel.

- Ten-year-old fuel was specified as the fuel to attempt to ship first from reactor pools. As long as this fuel does not exceed the design limits of the primary transportation cask, it will be shipped.
- Once all acceptable 10-year-old fuel has been shipped, the next oldest fuel will be tried, until the pool allocation has been filled or there is no more acceptable fuel greater than 10-years old at that site [allocation rights were assigned in accordance with Acceptance Priority Ranking and Annual Capacity Report, described in DOE 1995a]. At this point, younger fuel will be tried (from 9-years old through 5-years old).
- If the assemblies selected exceed the thermal limits for the primary cask, an alternate, more robust transportation cask (e.g., with a higher heat capacity) will be utilized to transport the assemblies.

- If the allocation still cannot be met (no acceptable 5-year or older fuel in the pool), fuel will be withdrawn from any onsite dry storage. If there is no onsite dry storage, the allocation will be deferred until next year.

This scenario allows the utility to eliminate large quantities of younger fuel, and still take ALARA occupational exposure considerations into account by loading the minimum number of casks.

Case B. This is a stricter variation of the Case A.

- A stricter variation of the Case A fuel selection method was also specified. Ten-year-old fuel was still specified as the fuel to attempt to ship first from reactor pools.
- If the limits of the primary cask are exceeded, rather than skipping that fuel, alternative, more robust casks are sequentially evaluated against assembly characteristics until an acceptable cask has been located.
- Once a cask type has been identified, the cask type is reset as the primary cask and the process repeats with the next fuel in the queue until the allocation is filled.
- Once all 10-year-old or older fuel has been accepted, younger fuel is selected (from 9-years old down to 5-years old).
- If the allocation still cannot be filled (no 5-year or older fuel in pool), fuel will be withdrawn from any onsite dry storage. If there is no onsite dry storage, the allocation will be deferred until next year.

This case assumes that the utilities are less concerned with the number of casks loaded than with the elimination of the hotter fuel from their pools. This case is considerably more stressing than Case A, since the requirement to take all fuel in strict age order results in the use of more transportation casks that can handle hotter fuel. These casks tend to have smaller capacities; therefore, more casks are required than with Case A. While Case B does not start with selection of the hottest fuel available (5-years old), it provides a relatively stressing, but still probable acceptance scenario.

Case C. Fuel selection begins with the oldest fuel still in the pool.

- Once the oldest fuel has been selected, or that fuel exceeds the primary cask limits, progressively younger fuel is tested for acceptance down to 5-year-old fuel.
- When there is no fuel that meets the primary cask limits, an alternative, more robust cask is tried.
- If the allocation still cannot be filled (no acceptable 5-year or older fuel in pool), then fuel will be withdrawn from any onsite dry storage. If there is no onsite dry storage, the allocation will be deferred until next year.

This case assumes that all utilities are willing to deliver the fuel that the DOE requests without regard to site-specific benefits of removing hotter fuel from utility pools. This case is included to provide sufficient variation in the possible waste to ensure that the design bounds plausible operational scenarios.

Case D. This is a stricter variation of Case B.

- The same strict variation of fuel selection was used as for Case B.
- The initial age of the fuel to begin attempting to ship was lowered to 5 years (from 10 years).
- Note that as the age of the fuel is already at the minimum, once all fuel older than the specified age is accepted from the pool, fuel is withdrawn from any onsite dry storage.

This case assumes that all utilities use the worst case fuel selection criteria allowed by the standard contract. This produces extremely stressing conditions for design, throughput, and thermal management. These worst case assumptions are counter to both CRWMS and utility site-specific considerations due to: (1) ALARA occupational exposure considerations for utility personnel, (2) the prohibitive amount of time required to load a large number of small casks, and (3) the large amount of lag storage required to cool fuel prior to emplacement in the repository. This case is theoretically possible, but not a practical limit. This case represents an extreme worst case scenario, and detailed analysis is not included in this report. Limits associated with this case should not be used as a design basis.

Case E. This is a variation of Case A.

- The same variation of fuel selection was used as for Case A.
- The initial age of the fuel to begin attempting to ship was lowered to 5 years (from 10 years).
- Note that as the age of the fuel is already at the minimum, once all acceptable fuel older than the specified age is accepted, fuel is withdrawn from any onsite dry storage.

This case is very similar to Case A and is considered to be of reasonable likelihood. While the number of transportation casks is roughly the same as Case A, the age distribution of the fuel is different. Due to the relatively low limits of the primary cask (most casks are designed to handle ten-year-old fuel), any fuel that would excessively stress the system is delayed. Because this case does not stress the system differently from Case A, and is bounded by Case B, it was not necessary to utilize this case for developing design data.

Table A-3 provides a summary of the cases. Note that all of the cases evaluated had at least 5 percent of the total acceptance being less than 10-years old (including some 5-year-old fuel).

Table A-3. Case Summary

Case	Initial Fuel Selection	Strict Age Order
A	10-year old	No
B	10-year old	Yes
C	Oldest still in pool	No
D	5-year old	Yes
E	5-year old	No